

A New Way to Start Acquisition Programs

DoD Instruction 5000.02
and the Weapon Systems
Acquisition Reform Act of 2009

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In their March 30, 2009, assessment of major defense acquisition programs, the Government Accountability Office (GAO) made this statement regarding cost growth:

While there are different ways to measure the extent and nature of cost growth, there is agreement between DOD and us on the sources of the problem: (1) programs are started with poor foundations and inadequate knowledge for developing realistic cost estimates; (2) programs move forward with artificially low cost estimates, optimistic schedules and assumptions, immature technologies and designs, and fluid requirements; (3) changing or excessive requirements cause cost growth; and (4) an imbalance between wants and needs contributes to budget and program instability.

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To remedy these problems, the under secretary of defense for acquisition, technology and logistics issued a new Defense Acquisition Management System instruction (DoDI Instruction 5000.02, Dec. 8, 2008) and the president signed into law the Weapon Systems Acquisition Reform Act of 2009 (WSARA, May 22, 2009). Both actions seek to ensure that acquisition programs start with realistic cost estimates and schedules—based upon mature technologies and designs—in fulfillment of a defined and stable set of performance requirements.

The purpose of this article is to explain the major tenets of these new statutory and regulatory changes and to propose new paradigms through which the program manager should think about cost, schedule, and performance when starting a new acquisition program (see the table on the next page). The table, Paradigm Shifts Based Upon DoDI 5000.02 and WSARA of 2009, depicts the new reviews, assessments, and requirements of the acquisition management system, and is a good reference as you read this article.

The WSARA of 2009 reinforces much of what was published in the new DoDI 5000.02, namely because the Office of the Secretary of Defense worked closely with congressional staff members to craft the language in the act to ensure support to reforms already under way. However, as will be seen, the WSARA of 2009 goes further in elevating the importance of certain aspects of DoDI 5000.02 reforms.

Cost and Schedule Considered in Performance Requirements

The WSARA of 2009 requires that Department of Defense officials responsible for cost estimates, budgeting, and acquisition all weigh in on system capability documents before they are validated by the Joint Requirements Oversight Council. Thus, the DoD director of cost assessment and program evaluation; the under secretary of defense (comptroller); and the under secretary of defense for acquisition, technology and logistics are to comment on tradeoffs between cost, schedule, and performance objectives as part of the requirements development process. This is the first major paradigm shift in how requirements for major defense acquisition programs are validated.

DoD Instruction 5000.02 reemphasizes that “evolutionary acquisition is the preferred DoD strategy for rapid acquisition of mature technology for the user.” In the new instruction, there is just one approach to evolutionary acquisition: incremental development. “Spiral development” is no longer used as an evolutionary acquisition strategy term; however, spiral development can still be used as an engineering term to describe a software development method. “An evolutionary approach delivers capability in increments, recognizing, up front, the need for future capability improvements. The objective is to balance needs

and available capability with resources, and to put capability into the hands of the user quickly.”

To reduce requirements creep, DoDI 5000.02 requires that “the Acquisition Executive of each DoD Component shall establish and chair a Configuration Steering Board (CSB) ... to review all requirements changes and any significant technical configuration changes for ACAT I and IA programs in development that have the potential to result in cost and schedule impacts to the program.” Boards are empowered to reject any changes and are expected to only approve those where the change is deemed critical, funds are identified, and schedule impacts are truly mitigated.

More Realistic Cost Estimates

In the past, the first cost estimate for an acquisition program was developed at program initiation, typically Milestone B. This has changed under the new DoDI 5000.02 and the WSARA of 2009. Now, “At Milestone A, the DoD Component shall submit a cost estimate for the proposed solution(s) identified by the AoA [analysis of alternatives].” The emphasis on early costing of the program is to support a Milestone A certification required by Congress (10 USC Section 2366a). In addition, the director of cost assessment and program evaluation shall conduct independent cost estimates and cost analyses for major defense acquisition programs and major automated information system programs in advance of section 2366a or 2366b certifications.

The WSARA of 2009 also requires the disclosure of the confidence levels for baseline estimates for major defense acquisition programs. Justification must be provided if the cost estimate is calculated at a confidence level that is less than 80 percent. By definition, a program estimated at the 80 percent confidence level has an 80 percent probability of coming in at that amount (or less) and a corresponding 20 percent probability of a cost overrun. However, if that same program is estimated at the 50 percent confidence level, it has only a 50 percent probability of coming in at that amount (or less) and may experience cost growth over time. That represents another paradigm shift in the way the military departments and defense agencies estimate the cost of programs, as setting confidence levels to 80 percent and budgeting to those amounts will drive up acquisition budgets, making cost overruns less likely but also making development programs less affordable.

Materiel Development Decision Review

An initial materiel development decision (MDD) review has replaced the concept decision. In the past, acquisition programs could enter the acquisition process at any milestone, provided they met the phase-specific entrance criteria. Now, an MDD review is required first for all potential acquisition programs. It is at that mandatory acquisition process entry point that the milestone decision authority ensures that the program is based on approved requirements and a rigorous assessment of alternatives. Then, according to DoDI

Paradigm Shifts Based Upon DoDI 5000.02 and WSARA of 2009

New Paradigm	Old Paradigm
Cost and schedule must be considered before performance objectives are established.	Performance objectives often established before cost and schedule were considered.
Costs estimated at 80% confidence level (for MDAPs).	With the exception of high-risk cost elements, most costs estimated at 50% confidence level.
Competitive prototyping before Milestone B.	Little prototyping because of cost.
Post-preliminary design review and critical design review assessments for the milestone decision authority make for more robust systems engineering.	Preliminary design review and critical design review were recommended as "best practice" technical reviews.
Independent technological maturity and integration risk assessment by director, defense research and engineering.	Program manager assessed technology readiness level in accordance with <i>Defense Acquisition Guidebook</i> .
Ensure competition at both prime and subcontract levels.	Competition at prime level; prime responsible for subcontract competition.

5000.02, "The MDA may authorize entry into the acquisition management system at any point consistent with phase-specific entrance criteria and statutory requirements."

Materiel Solution Analysis Phase

The materiel solution analysis (MSA) phase has replaced the concept refinement phase. While an MSA decision to enter the new materiel solution phase doesn't mean that a new acquisition program has been initiated, the new term implies that some type of material solution is being pursued.

The AoA is the key activity of the MSA phase. DoDI 5000.02 calls for a more robust AoA than in the past. "The purpose of the AoA is to assess the potential materiel solutions, identify key technology elements, and estimate life cycle costs, in order to satisfy the capability needs documented in the approved initial capabilities document (ICD)." The AoA must also assess appropriate system training and alternative ways to improve energy efficiency. Additionally, resource estimates must use the fully burdened cost of delivered energy in trade off analyses. As mandated by the WSARA of 2009, the DoD director of cost assessment and program evaluation develops the AoA study guidance for major defense acquisition programs.

Technology Development Phase

The name of the technology development (TD) phase was not changed. However, both the WSARA of 2009 and DoDI 5000.02 require competitive prototyping in that phase.

In a significant paradigm shift for major defense acquisition programs, acquisition strategies must now provide for

competitive prototyping of systems or critical subsystems before Milestone B approval, unless waived by the MDA. Yet even if the MDA waives the requirement for competitive prototyping, a single prototype must still be produced. In addition, the Government Accountability Office will review all waivers and submit their assessment of compliance with this statute to the Congress.

Programs that have historically used prototyping in their acquisition strategies have seen improved performance and increased technological and design maturity. The effort to produce a prototype also helps in understanding development and production costs and aids in the refinement of the program cost estimate. However, even a single prototype, not to mention multiple prototype contracts, can drive up development costs.

During the TD phase, statute and regulation also require that major defense acquisition programs conduct a system-level preliminary design review (PDR). Per DoDI 5000.02, "A successful PDR will inform requirements trades; will improve cost estimation; and identifies remaining design, integration, and manufacturing risks."

The cost-performance trades that result from knowledge gained during competitive prototyping can help keep the program affordable and within the Milestone A component cost estimate. A post-PDR assessment by the MDA is also required, and its purpose is to establish the allocated baseline for the system and to approve requirements trades.

The TD phase is guided by the ICD, draft capabilities development document (not stated in DoDI 5000.02, but implied), and the technology development strategy; and is supported by systems engineering planning. "The project shall exit the TD Phase when a affordable program or increment of militarily useful capability has been identified; the technology and manufacturing processes for that program or increment have been assessed and demonstrated in a relevant environment; manufacturing risks have been identified; a system or increment can be developed for production in a short timeframe (normally less than 5 years for weapon systems); or, when the MDA decides to terminate the effort," according to DoDI 5000.02.

The WSARA of 2009 also requires an independent assessment by the director of defense research and engineering of the technological maturity and integration risk of the critical technologies of major defense acquisition programs. In addition, the director of defense research and engineering is to develop knowledge-based standards

against which to measure the technological maturity and integration risk of critical technologies at key stages in the acquisition process. In the past, the program manager was responsible for technology readiness assessments that were based upon definitions provided in the *Defense Acquisition Guidebook*. While the director of defense research and engineering has yet to announce its technological maturity and integration risk standards, one can expect them to be different from the *Defense Acquisition Guidebook* definitions, perhaps requiring knowledge-based evidence from testing in order to meet the standards.

Engineering and Manufacturing Development Phase

The engineering and manufacturing development (EMD) phase has replaced the old systems development and demonstration phase. The new name for the phase implies that the system (e.g., prototype) works and is ready to be engineered into a producible design. It is in this phase that tools and techniques are to be developed and demonstrated for the manufacturing of the system. A key objective of the EMD phase is to establish the product baseline for all configuration items, resulting in more emphasis on systems engineering and technical reviews.

The EMD phase is guided by the capabilities development document, acquisition strategy, systems engineering plan, and test and evaluation master plan. The acquisition strategy is prepared by the program manager and approved by the MDA.

The EMD phase consists of two efforts, the first of which is the integrated system design (ISD) that is intended to define system and system-of-systems functionality and interfaces, complete hardware and software detailed design, and reduce system-level risk. ISD includes establishment of the product baseline for all configuration items. Completion of that effort is evidenced during a system-level critical design review (CDR), conducted by the government program manager and the contractor. Following the CDR, a mandatory post-CDR assessment has replaced the old design readiness review. Its purpose is to tie the product baseline to a decision by

the MDA to continue into the second effort of the EMD phase. Elevating the post-CDR to the MDA level is expected to strengthen the systems engineering effort.

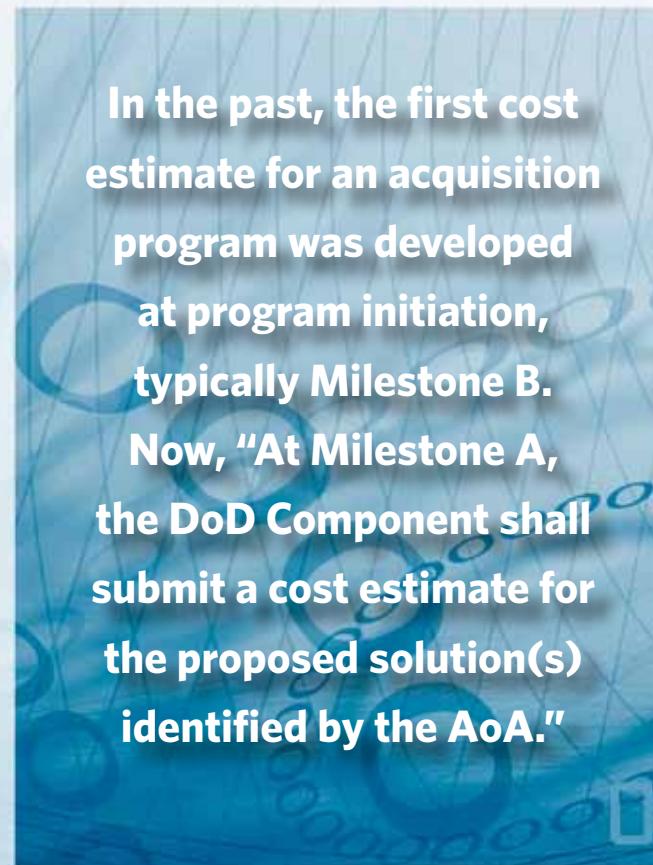
Systems capability and manufacturing process demonstration, the second effort in the EMD phase, is intended to demonstrate the ability of the system to operate in a useful way consistent with the approved key performance parameters, and that system production can be supported by demonstrated manufacturing processes. "This effort shall end when the system meets approved requirements

and is demonstrated in its intended environment using the selected production-representative article; manufacturing processes have been effectively demonstrated; industrial capabilities are reasonably available; and the system meets or exceeds exit criteria and Milestone C entrance requirements," according to DoDI 5000.02.

As was the practice under the old version, the new DoDI 5000.02 requires that programs entering the EMD phase be fully funded in the future years defense program. That means before entering the EMD phase at Milestone B, all of the dollars and manpower needed to carry out the acquisition strategy have to be included in the budget and out-year program. Obviously, a program that is only partially funded is more likely to fail.

The WSARA of 2009 requires that the secretary of defense ensure competition or the option of competition—at both prime contract level and the subcontract level—throughout the life cycle of the program, as a means to improve contractor performance. While ensuring competition at the prime contract level is not new, guidance on government involvement in subcontracting competition has been strengthened. The law requires that the government ensure fair and objective "make-buy" decisions by prime contractors on major defense acquisition programs. Government surveillance of contractor sourcing decisions and the assessment of sourcing fairness and objectivity in past performance evaluations are also mandated.

Under the new DoDI 5000.02, test activities are integrated into every acquisition development phase for early





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The cost-performance trades that result from knowledge gained during competitive prototyping can help keep the program affordable.

tative or production articles for live fire test and evaluation and initial operational test and evaluation. There can be significant costs and schedule impacts associated with those test articles and tests.

A Better Acquisition Program

The new DoDI 5000.02 and the WSARA of 2009 mandate changes to the acquisition management system to fix mismatches between requirements, cost estimates, and budgets. The new MDD review—required for all programs—added emphasis on the AoA, and a component cost estimate at Milestone A should help to harmonize actions in the requirements budgeting and acquisition management systems. Knowledge gained from mandated competitive prototyping should also help detect immature technologies and inject more realism into early cost estimates. If implemented, cost-saving trades identified during prototyping can help keep program costs within initial cost estimates. Likewise, configuration steering boards can help put a stop to changing or excessive requirements growth and help contain cost. Finally, full funding upfront for required test articles, statutory tests and evaluations, and formal technical reviews will give new development programs a better chance at succeeding.

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identification and correction of technical and operational deficiencies. The new instruction also requires that the deputy under secretary of defense for acquisition and technology conduct an independent assessment of operational test readiness for all ACAT ID and special interest programs.

For programs on the Office of the Secretary of Defense Test and Evaluation Oversight List, the director of operational test and evaluation, in coordination with the program manager, determines the number of production-represen-